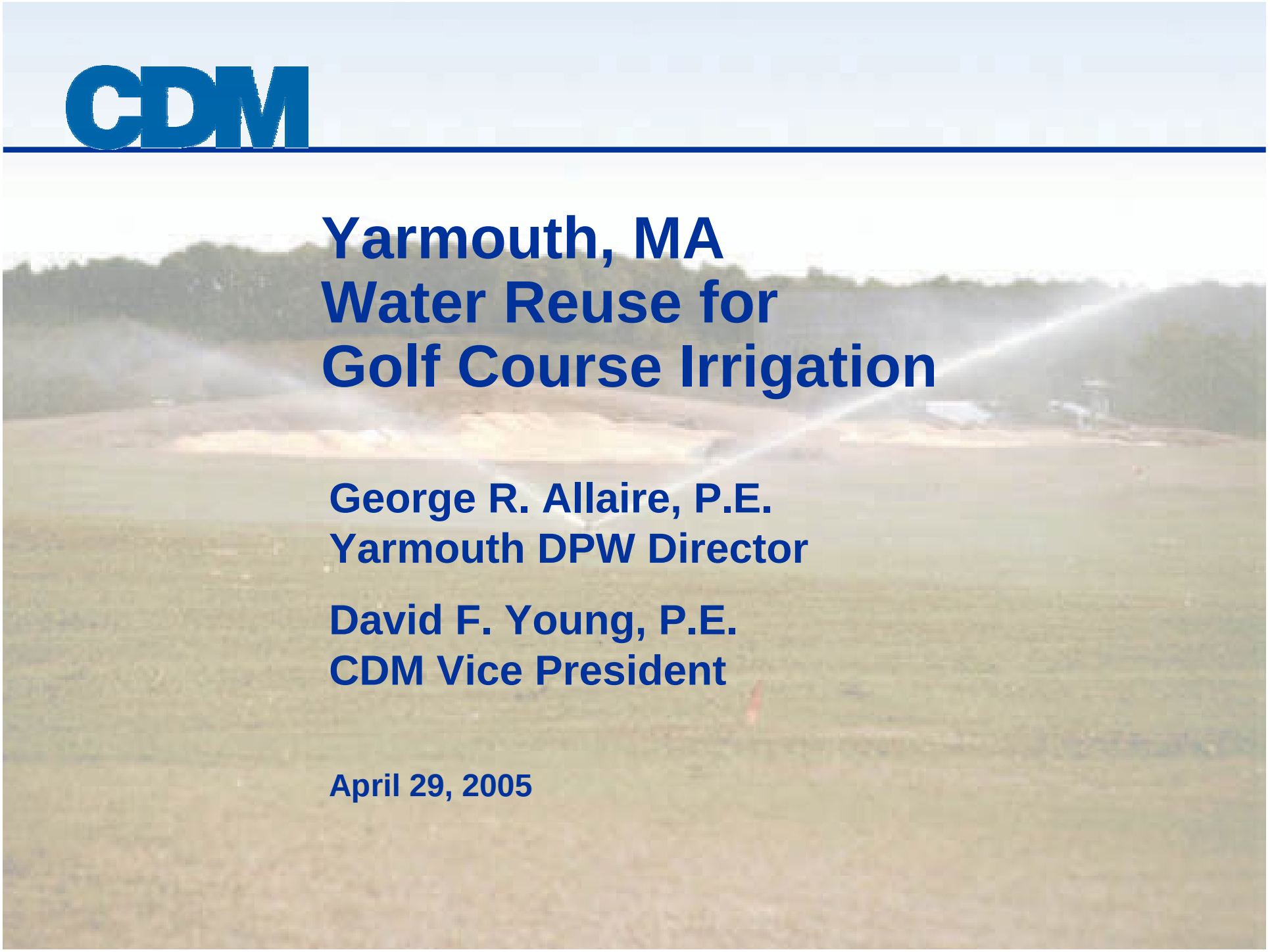


Yarmouth, MA
Water Reuse for
Golf Course Irrigation

George R. Allaire, P.E.
Yarmouth DPW Director

David F. Young, P.E.
CDM Vice President

April 29, 2005

Concept Plan Development: 1995-1999

- 57-acre municipal landfill needed to be closed and capped
- Landfill located in Aquifer Protection District (APD)

- Town wanted a “Reuse” project— potential for generating revenues
- Recommended nine-hole expansion to the existing town owned Bayberry Hills Golf Course

BUT…

- Needed to find source of irrigation water as town drinking water supplies were already stressed and couldn’t meet 18 million gallon (MG) annual water demand for added holes
- Golf course irrigation water demand and municipal water system demand for a tourist community both have peaks in July/August

Existing Facilities

- Adjacent Yarmouth-Dennis Septage Treatment Plant
- 21 mg Treatment and effluent disposal capacity
- Seasonal discharge to land 3 miles away outside APD
- 10.5 mg onsite storage tank

Effluent Disposal

10.5 mg Storage Tank

Septage Treatment Plant

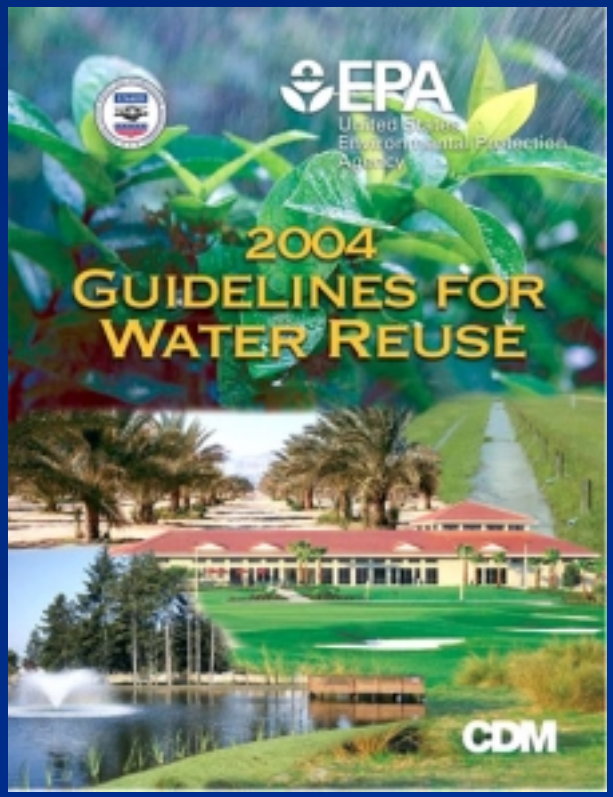
Links at Bayberry Hills Golf Course

Regulatory Process: 1996-2001

- Spring 1996 concept presented to DEP
- Massachusetts at the time was one of a few states without reclaimed water guidelines or regulations
- Cooperative spirit and education network lead all parties to believe this was a “reclaimed water project waiting to happen”
- Town authorized treatment studies and risk assessments to help gain acceptance
- DEP decided project could be permitted via Groundwater Discharge Permit process—issued interim guidelines on reclaimed water in 1999

General Requirements

- Treatment
  - Secondary
  - Filtration
  - High level disinfection
- Back-up Facilities
  - 100 percent redundancy or storage for non-growing season or non-permit compliance periods



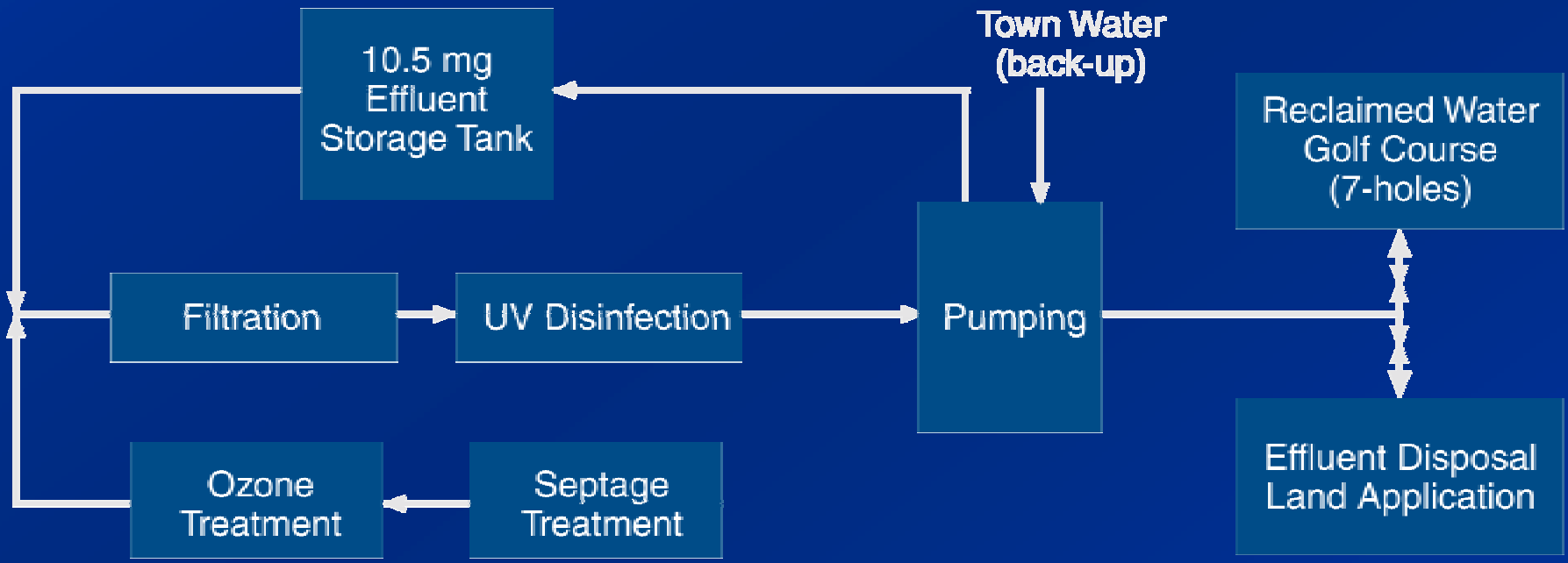
Comparison of Key Discharge Limits

Characteristic	Existing Disposal	Reclaimed water
Total Suspended Solids	30 mg/L	5 mg/L
Turbidity	NA	2 NTU
Fecal Coliform Bacteria	2 Total	No detectable colonies / 100 mL *
Nitrate Nitrogen	10.0 mg/L	14.0 mg/L **
Total Nitrogen	10.0 mg/L	14.0 mg/L **

* Median value from last 7 days of results

** 10.0 mg/L average in golf course underflow

Reuse Schematic

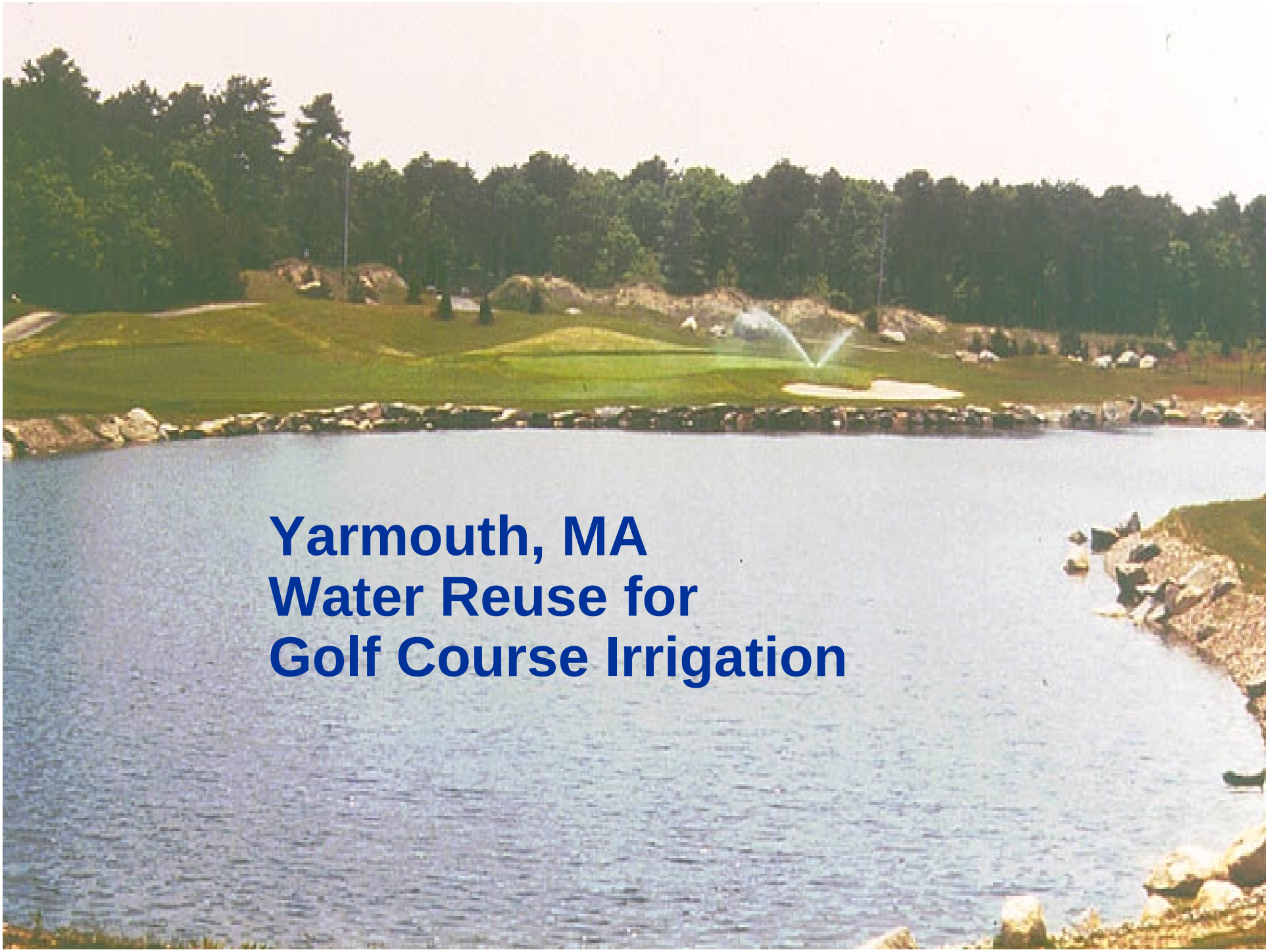


Key Issues

- Town strongly endorsed program from day one
- Agronomic application process versus daily disposal
- Net reduction in overall nitrogen applied
- Two phased start-up testing and monitoring program utilized
- Developed “Groundwater Protection Management Plan”
- Town sells reclaimed water at same rate as municipal water

Summary

- Town utilized over 12 mg of reclaimed water in 2004 for golf course irrigation
- Existing facilities helped make this a more economical project
- Education to address perceptions is key — general public, users, workers, regulatory, etc.
- Yarmouth should be congratulated for stepping up and pushing this first large scale reclaimed water project in MA



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